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Federal Communications Commission
Office of Secretary

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

05-256

In the Matter of	)	
	)	
Applications for Transfer of Control of	)	Wireless Telecommunications Bureau
Licensee WCS Wireless License Subsidiary,	)	File No. 0002240823
LLC from WCS Wireless, Inc. to	)	
XM Satellite Radio Holdings Inc.	)	

PETITION TO DENY OF SIRIUS SATELLITE RADIO INC. AND REQUEST FOR REMOVAL FROM STREAMLINED PROCESSING

Sirius Satellite Radio Inc. ("Sirius"), pursuant to Section 309(d) of the Communications Acts of 1934, as amended, and Section 1.939 of the rules of the Federal Communications Commission ("FCC" or "Commission"),[1] hereby petitions to deny the above-referenced application for transfer of control of WCS Wireless License Subsidiary Inc. ("Licensee" or "WCS License Sub") from WCS Wireless Inc. ("Transferor" or "WCS Wireless") to XM Satellite Radio Holdings Inc. ("Transferee" or "XM"). As explained below, the Transferee's proposed use of the WCS spectrum may cause harmful interference to Sirius' satellite digital audio radio service ("satellite DARS"), which operates in adjacent spectrum. Given that such interference would not serve the public interest, the FCC should deny the transfer of control. As a minimum, prior to approving XM's acquisition of WCS License Sub, the FCC should complete its terrestrial repeater rulemaking in order to avoid the impossible situation of XM sitting on both sides of the satellite DARS and WCS negotiating table. Sirius further requests that the Wireless Bureau, pursuant to Section 1.948(j)(1)(iv) of the Commission's rules,[2] remove XM's

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1 47 U.S.C. § 309(d); 47 C.F.R. § 1.939.

2 47 C.F.R. § 1.948(j)(1)(iv).

application from streamlined processing and proceed by written order.

I. INTRODUCTION AND BACKGROUND

Sirius and XM are licensed by the Commission to provide satellite DARS. Both companies operate a subscription-based service offering music, news, sports and entertainment programming. Sirius and XM collectively reach more than six million subscribers. Sirius operates in 12.5 MHz from 2320-2332.5 MHz, transmitting from its satellites in the "outer portions" of this spectrum and via terrestrial repeaters in the center portion. The company XM seeks to acquire is licensed, *inter alia*, in "C block" spectrum[3] immediately adjacent to (below) Sirius' satellite transmissions at 2320 MHz. As both a competitor and adjacent spectrum holder, Sirius unquestionably is a party in interest to XM's proposed acquisition.[4]

The WCS service was created by the FCC in a manner to protect satellite DARS. The WCS spectrum was carved out of the domestic table of frequency allocations for satellite DARS and accompanied by rules designed to protect satellite DARS operations. Indeed, in adopting such rules, the Commission noted that it "must ensure that WCS operations do not cause harmful interference or disruption to adjacent satellite DARS reception."[5] The FCC further codified various technical rules to protect satellite DARS subscribers despite acknowledging that such limitations might make some WCS services "technologically infeasible."[6] The reduced auction price for the WCS spectrum reflected the necessity to protect satellite DARS.[7]

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3 *Id.*, § 27.5.

4 *See* 47 U.S.C. § 309(d)(1); 47 C.F.R. § 1.939(d).

5 *Wireless Communications Service ("WCS")*, 12 FCC Rcd 10,785, 10,854 (¶ 136) (1997) (Report and Order).

6 *Id.* at 10,787 (¶ 3).

Indeed, because WCS spectrum always was required to yield to adjacent-spectrum

Since the adoption of services rules and the auction, WCS development has stalled. Indeed, the only WCS licensee to commence operations, Metricom, subsequently entered bankruptcy. Today, neither the Transferor nor any other remaining WCS licensee has constructed a network nor begun commercial operations. Yet, as the Bureau well knows, all WCS licensees must demonstrate "substantial use" by July 2007 or "forfeit" their licenses.[8]

The dormancy of its existing spectrum notwithstanding, earlier this year the Transferor also purchased the spectrum originally licensed to VoiceStream GSM II, LLC.[9] XM now proposes to buy the licensee of this consolidated spectrum—which comprises a large geographic swath across the middle and western United States—for an amount two orders of magnitude greater than the auction price.

As described in the exhibits to its application, XM seeks access to this spectrum so it may "develop a system capable of providing a wide range of new and innovative mobile multimedia subscription services."[10] Such mobile media services are likely to include video clips, local weather, news, music, sports, and other data services. Nonetheless, there is no way to

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(Continued . . .)
satellite DARS, the WCS licensees acquired their spectrum at a significantly lower auction price than the satellite DARS licensees, roughly $13 million compared to $170 million. *WCS Auction Closes: Winning Bidders in the Auction of 128 Wireless Communications Service Licenses,* 12 FCC Rcd 21,653 (Apr. 28, 1997) (Public Notice). Importantly, the WCS auction post-dated both the WCS rules and the satellite DARS auction, reinforcing the fact that WCS licensees understood the technical constraints.

[8] 47 C.F.R. § 27.14(a) ("WCS licensees must make a showing of 'substantial service' in their license area").

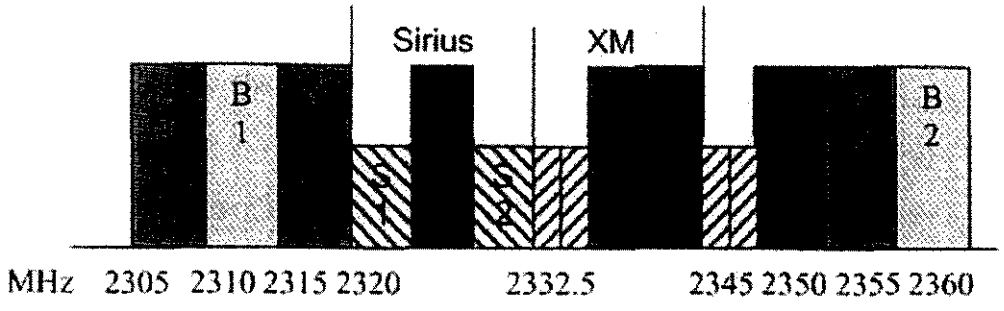
[9] *Assignment of License Authorization Applications*, Rep. No. 2162, at 7 (WTB May 25, 2005) (Public Notice).

[10] File No. 002240823, Application, Ex. 2.

determine precisely which services XM will offer.[11]

II. XM'S USE OF THE WCS FREQUENCIES MAY CAUSE HARMFUL INTERFERENCE TO SIRIUS' SATELLITE DARS CONTRARY TO THE PUBLIC INTEREST

Operation of XM's proposed "mobile multimedia subscription services" in portions of the WCS band and its operation of terrestrial repeaters in its licensed satellite DARS band may cause harmful interference to Sirius' provision of satellite DARS. The relationship of satellite DARS and WCS spectrum is shown below.



T=satellite DARS terrestrial channel

As described in the attached technical appendix, the likely collocation of XM's A, B or D-block WCS transmitters and satellite DARS terrestrial repeaters will result in third-order intermodulation products that will deliver interfering signals to Sirius receivers at least 23 dB greater than that now generated by XM's existing terrestrial repeaters. Such an interfering signal level will incapacitate Sirius receivers in the near vicinity of XM's numerous terrestrial repeater sites.

Indeed, the magnitude of intermodulation interference may so impair its satellite signal that Sirius would be compelled to deploy additional terrestrial repeaters. The widespread

[11] 47 C.F.R. § 27.2 (permitting WCS licensees to offer "any services for which its frequency bands are allocated").

deployment of additional terrestrial repeaters necessary to overcome XM's terrestrial transmissions could transform the purpose of Sirius' repeaters from gap-filling to interference mitigation. Operation of so many additional terrestrial repeaters may also shift their purpose from a "complement" to the satellite signal to a primary mode of satellite DARS reception.

Given this technical concern, and without further assurance from Transferor and XM, the Commission and the Wireless Bureau cannot now be certain that the grant of the application would be consistent with the public interest, convenience and necessity. Satellite DARS is a mass-market entertainment service, which necessitates high availability. In addition, Sirius provides emergency information, which requires uninterrupted reception in times of crisis. Accordingly, the Bureau should deny XM's acquisition of WCS License Sub.

III. THE COMMISSION MUST CONCLUDE THE LONG-PENDING TERRESTRIAL REPEATER RULEMAKING PRIOR TO XM'S ACQUISITION OF WCS SPECTRUM

As a minimum, the Wireless Bureau should hold in abeyance the pending application for XM to acquire control of WCS License Sub until completion of the long-overdue satellite DARS terrestrial repeater rulemaking. The Commission first proposed repeater rules in 1995[12] and refined its proposal in a Further Notice of Proposed Rulemaking in 1997.[13] Thereafter, the Commission issued several public notices seeking additional comments—one in late 1997,[14]

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[12] *Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, 11 FCC Rcd 1 (1995) (Notice of Proposed Rulemaking).

[13] *Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, 12 FCC Rcd 5754 (1997) (Report and Order Memorandum Opinion and Order and Further Notice of Proposed Rulemaking).

[14] *Satellite Policy Branch Information: Applications Accepted for Filing*, Rep. No. SPB-112 (Dec. 23, 1997) (Public Notice) (establishing a reply comment deadline of January 9, 1998).

another in early 2000[15] and a third in 2001.[16]

Since that time, the WCS and satellite DARS licensees have been negotiating "to develop potential rules that would effectively permit both the SDARS licensees and the WCS licensees to deploy communications systems without harmful interference."[17] The negotiations include considerations of "reciprocity between WCS and DARS" and "relaxation of limits on WCS."[18] Thus far, the negotiations have identified, but not yet resolved, direct overload and intermodulation interference into the WCS band. The negotiations have not yet even commenced with respect to analyzing interference from WCS into satellite DARS. To date, this interference concern has been modest given the lack of WCS implementation.

XM's proposed acquisition makes the need to address and resolve interference into satellite DARS immediate. As noted above, XM's co-located use of A, B and D-block WCS spectrum and operation of terrestrial repeaters raises intermodulation concerns. In addition, XM's proposed operations in the C-block (*i.e.*, 2315-2320 MHz), which is directly adjacent to Sirius' satellite DARS downlinks, may cause harmful blanketing interference to Sirius' satellite transmissions in the adjacent spectrum.[19]

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15 *Satellite Policy Branch Information*, IB Docket No. 95-91, Gen. Docket No. 90-357 (Jan. 21, 2000) (Public Notice) (establishing a comment deadline of February 22, 2000 and a reply comment deadline of March 8, 2000).

16 *Request for Further Comment on Selected Issues Regarding the Authorization of Satellite Digital Audio Radio Service Terrestrial Repeater Networks*, Rep. No. SPB-176 (Nov. 1, 2001) (Public Notice) (requesting further comment on selected issues regarding satellite DARS terrestrial repeater networks) ("*Public Notice*").

17 Letter from Mary N. O'Connor to Marlene H. Dortch, *Notice of Ex Parte Presentation*, IB Docket 95-91 (dated Nov. 13, 2003).

Id., Attachment at 8.

19 Specifically, the high spectral density associated with XM's proposed terrestrial transmissions would cause spot interference that would override Sirius' satellite signal. As such,

Approval of the transfer, however would place XM on both the "WCS" and "satellite DARS" sides of the negotiating table and thus stymie the negotiations. Indeed, Sirius would be in the impossible position of debating interference protection with its principal competitor.[20] XM would be in the similarly undesirable position of advocating for one side of its business at the expense of the other. In such circumstances, the negotiations could not proceed in good faith and would be doomed to failure.[21]

To avoid such an untenable situation, the Wireless Bureau should hold XM's application to acquire WCS License Sub in abeyance until the satellite DARS and WCS licensees conclude negotiations or the Commission enacts rules to protect Sirius' satellite DARS operations.

(Continued . . .)
Sirius subscribers' receivers would "see" XM's in-band signal and effectively "mute" the intended satellite signal. XM's business plan indicates that such overload may be quite rampant. XM proposes to offer "services similar to those under development in the 700 MHz band (Qualcomm)." Application, Ex. 2. Qualcomm plans to operate "at 25 kw effective radiated power (ERP) in vertical and horizontal polarizations, for total ERP of 50 kw, using a circularly polarized antenna." Communications Daily, Aug. 2, 2005, at 6. In order to provide "similar" service, XM would have to deploy thousands of 2 kw peak equivalent isotropically radiated power (eirp) transmitters, which would augment the geographic area within which Sirius' receivers will experience front end overload. In response, Sirius would have to expand its own terrestrial repeater network thus shifting its terrestrial operations from complementary to a primary mode of satellite DARS reception.

[20] To the extent final DARS rules require prior notice of changes to the repeater installations, XM's WCS affiliate would unfairly acquire secret and commercially sensitive information not normally available to competitors.

[21] Indeed, in other proceedings the Commission has noted the dangers of affiliated parties being on both sides of a negotiation. *See e.g., Interconnection Between Local Exchange Carriers and Commercial Mobile Radio Service Providers; Equal Access and Interconnection Obligations Pertaining to Commercial Mobile Radio Service Providers*, 11 FCC Rcd 5020, 5026 (¶ 13) (1996) (noting the potential for harmful results where opposing parties in a negotiation are affiliates).

IV. THE WIRELESS BUREAU SHOULD REMOVE XM'S APPLICATIONS FROM STREAMLINED PROCESSING AND PROCEED BY WRITTEN ORDER

In light of the concerns raised herein, the Wireless Bureau should remove XM's applications to acquire control of WCS License Sub from streamlined processing. Under Section 1.948 of the rules, the Wireless Bureau, within twenty-one days of public notice, must consent to, deny or remove XM's application from streamlined processing "for further review."[22] Removal of an application is appropriate where, as here, additional time is needed to address issues raised in a petition to deny.[23]

Accordingly, the FCC should issue a public notice confirming that the public interest requires removal of the application from streamlined processing. Furthermore, the FCC should require XM to put on the record basic technical information with respect to its planned implementation of WCS frequencies so that the Commission and interested parties can more accurately evaluate potential harmful interference. For example, the Commission should request that XM describe its planned WCS deployment, including the number of transmitter sites by radio frequency, approximate geographical location, EIRP (or maximum on the ground power flux densities) and modulation. Thereafter, the Wireless Bureau should address Sirius' interference concerns and act on the proposed transfer of control in a written order.

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22 47 C.F.R. § 1.948(j)(1)(iv).

23 *See Promoting Efficient Use of Spectrum*, 18 FCC Rcd 20,604, 20,683-84 (¶ 198) (2003) (noting that, for streamlined applications, if oppositions are filed that raise "issues that cannot be resolved within the abbreviated time frame, [the Commission] will . . . remove the application from streamlined processing so that additional information that require [sic] further examination can be gathered"); *see, e.g., Assignment of License Authorization Applications*, Rep. No. 1870, at 11 (WTB June 30, 2004)) (removing an application from streamlined processing following petitions to deny).

IV. CONCLUSION

For the foregoing reasons, Sirius urges the Wireless Bureau to remove XM's application from streamlined processing and to deny the application unless the Commission first remedies any risk of interference to Sirius' satellite DARS customers and concludes the terrestrial repeater rulemaking.

Respectfully submitted,

SIRIUS SATELLITE RADIO INC.

By: _____

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Dated: August 3, 2005

TECHNICAL APPENDIX

Intermodulation Interference to Sirius Receivers Generated by Co-Located Terrestrial WCS and SDARS Repeaters

Interference Concerns from WCS Terrestrial Transmitters into SDARS

Overview: This engineering statement considers the interference effects that Sirius satellite digital audio radio service (SDARS) receivers can expect to incur as a result of XM's deployment of new terrestrial WCS facilities in coordination with its existing network of terrestrial SDARS transmitters.

Sirius provides digital audio radio service throughout the CONUS primarily through its satellite delivery network. Within its licensed spectrum, Sirius allots the lower and upper thirds of its allocated spectrum to transmit its satellite signals. These spectrum blocks are depicted in Slide 3 as S1 and S2.

In the center third of licensed spectrum (labeled T_s in Slide 3), Sirius broadcasts its national service through gap-filling terrestrial transmitters in areas where there are substantial blockages of line of sight to the Sirius satellites. Sirius has designed its architecture to be highly reliant on its satellite delivery in order to minimize the number of terrestrial transmitters required for gap-filling, thus reducing the potential that Sirius terrestrial transmissions might interfere with other ground based services. Furthermore, the Sirius system architecture has been designed to provide gap-filling typically from transmitters located substantially above street levels in order to further minimize the potential for interference with others while providing seamless coverage to our customers.

Sirius receivers are tuned to receive substantially our entire licensed spectrum, demodulate the available signals and utilize combining algorithms to maximize the reception margin. The receivers utilize filtering to limit the influence of signals that are out of band, however, realizable filters are unable to significantly attenuate strong signals directly adjacent to signals of interest in the passband. The transition between the passband and the stopband cannot be a "brick wall", and therefore potential interference can occur from sources outside of the frequency band of interest.

Intermodulation Interference: The principal interference concern raised by XM's proposed use of WCS spectrum is intermodulation interference (IM). IM is caused when two or more signals interact in a receiver component and generate signals at additional frequencies that may then cause interference to a desired signal. One example of such a component would be the high gain, low noise amplifier used as part of a satellite radio receiver such as Sirius receiver. The potential for poorly managed IM to disrupt radio service has been well documented in the FCC's deliberations on interference to public safety communications systems operating in the 800 MHz band.

Sirius has been diligent in working on spectrum coordination activities with WCS licensees and XM to address potential interference into WCS bands that may arise from intermodulation products created by SDARS terrestrial transmitters that are either co-located or nearly co-located. Intermodulation products must be treated by effective coordination between the transmitters, as the ability of the receiver to filter these products once created is limited.

In geographic areas where XM holds licenses in multiple WCS bands, it is expected that they will co-locate transmitters to minimize network costs. This action would enhance the creation of intermodulation products that would fall into the Sirius SDARS band, significantly impairing the receiver's capabilities. These intermodulation products could cause interference to both the desired satellite and terrestrial signals within the Sirius SDARS band.

The type of IM that is most usually considered because of its magnitude and effect is third order IM (IM3). The following equation is used to calculate the relevant intermodulation frequency components:

> *For two frequencies Fa and Fb, the frequencies for the IM3 products are 2*Fa-Fb and 2*Fb-Fa.*

XM transmits their composite terrestrial repeater signal centered at 2338.75 MHz. The WCS frequencies associated with the D block are 2345 to 2450 MHz, the upper A block 2350 to 2355 MHz and the upper B block 2355 to 2360 MHz.

The potential intermodulation interference for an XM SDARS terrestrial frequency of 2338.75 MHz is illustrated in Table 1 for certain spot frequencies. In practice, because the signals are broadband, actual interference extends over a continuous range.

WCS Transmission Frequency (MHz)	Third Order Intermod Product (MHz)	Sirius Usage
2345 (D-Block)	2332.5	S2
2346 (D-Block)	2331.5	S2
2347 (D-Block)	2330.5	S2
2348 (D-Block)	2329.5	S2
2349 (D-Block)	2328.5	
2350 (D-Block)	2327.5	Terrestrial
2351 (A-Block)	2326.5	Terrestrial
2352 (A-Block)	2325.5	Terrestrial
2353 (A-Block)	2324.5	
2354 (A-Block)	2323.5	S1
2355 (A-Block)	2322.5	S1
2356 (B-Block)	2321.5	S1
2357 (B-Block)	2320.5	S1
2358 (B-Block)	2319.5	
2359 (B-Block)	2318.5	
2360 (B-Block)	2317.5	

Table 1: Intermodulation Frequencies Involving XM's Terrestrial SDARS Repeaters and WCS Terrestrial Transmitters

The result of this intermodulation analysis is graphically depicted in Slide 4

Sirius has performed laboratory measurements on its current satellite receivers to determine the level at which Sirius service is disrupted if two equal level signals are received, one from a current XM SDARS repeater and one from a new co-located transmitter operating in the WCS band. While the exact disruption level depends on the particular WCS block considered, the type of desired signal assumed and other environmental conditions, a representative value is -46 dBm. That is, when a Sirius receiver is receiving an average level satellite signal on S1 or S2 of -100 dBm, service will be disrupted if two undesired signals of -46 dBm or greater are received, one being XM's repeater signal and the other being a WCS D, upper A or upper B block signal.

Assuming transmitting facilities of 2,000 watts EIRP, it can be predicted that a combination of the XM's WCS and SDARS terrestrial transmitters will interfere with Sirius receivers for up to 2.5 kilometers from the co-located antenna site using free space propagation. In areas where free-space propagation cannot be assumed, the interference zones may still exceed 1,500 meters, particularly if XM uses sectorized antennas.

This analysis is demonstrated in Slides 5 and 6. Further, in most markets, XM operates an entire network of terrestrial repeaters. If each of these sites were turned into a source of intermodulation interference, the cumulative effect on Sirius service would be severe. The analysis for the Philadelphia market, where XM operates a total of 26 terrestrial transmitters is depicted in Slides 7-10.

To further emphasize the likely impact of a network of repeaters, in order to meet their stated objective of deploying a service similar in coverage to Qualcomm's proposed Mediaflo™, XM would have to build a significant number of additional repeaters. As an example, for the Philadelphia market it is estimated that in addition to co-locating WCS transmitters with the existing base of 26 SDARS sites, an additional approximately 85 sites would be needed.

Conclusion.

- This exhibit has demonstrated how the co-location of XM SDARS transmitters and WCS transmitters could cause new intermodulation products and consequently disrupt Sirius service.
- Receiver measurements have been presented that show the level at which this disruptive interference will be caused to Sirius service by this new mechanism.
- Examples have been presented showing the increase in interfering areas that will occur using both free space estimates and a real world market example.
- In all cases the increase in area is significant.

Technical Appendix

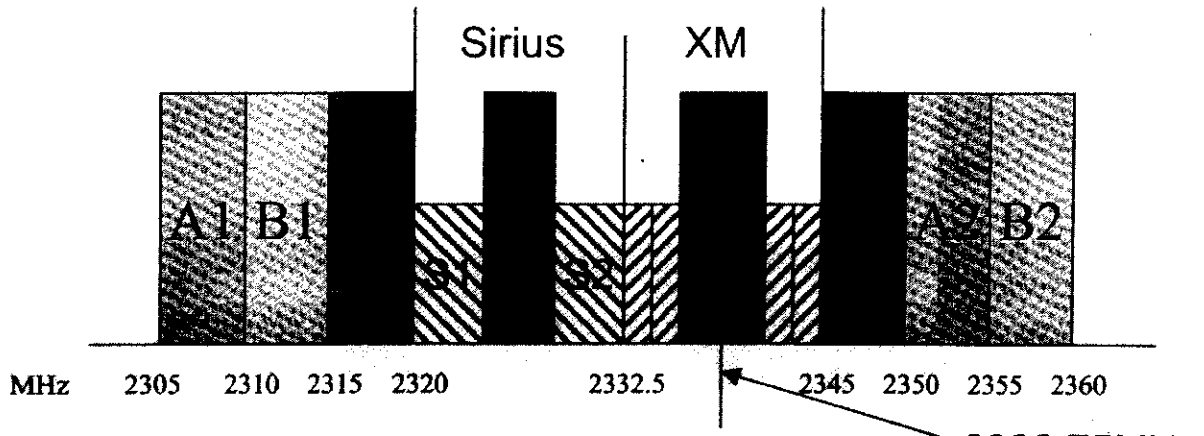
Intermodulation Interference to Sirius Receivers Generated by Co-Located Terrestrial WCS and SDARS Repeaters

Description of Intermodulation Interference Mechanism

- Intermodulation interference (IM) is caused when two or more signals interact in a receiver component and generate signals at additional frequencies which may then cause interference to a wanted service. One example of such a component would be the high gain, low noise amplifier used as part of a satellite radio receiver such as Sirius's receiver.
- The potential for poorly managed IM to disrupt radio service has been well documented, especially in the 800 MHz Public Safety services.
- The type of IM that is most usually considered because of its magnitude and effect is third-order intermodulation (**IM3**). The determination of the frequency components involved is made by applying the following calculation:

  For two frequencies Fa and Fb, the frequencies for the IM3 products are 2*Fa-Fb and 2*Fb-Fa. (See Section 10.3.2.4 of "Foundations of Mobile Radio Engineering", M. Yacoub, CRC Press ISBN 0-8493-8677-2)

SDARS and WCS Bandplan



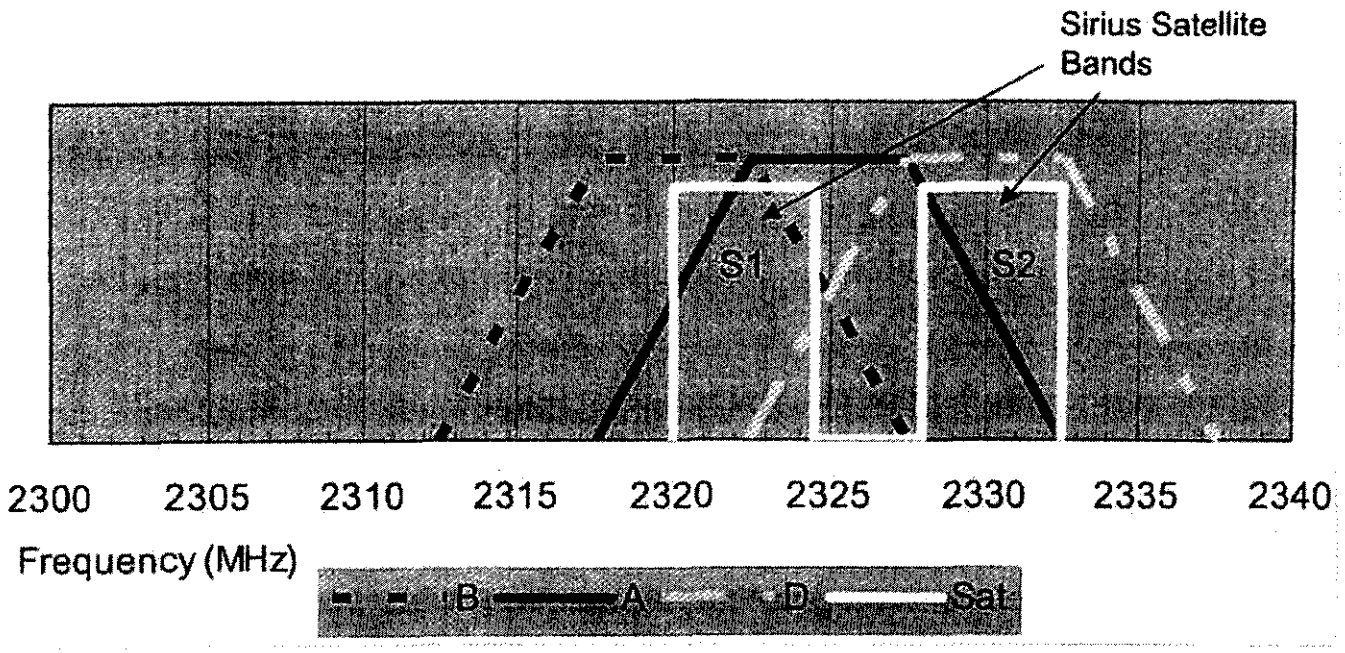
Ts= Sirius repeater channel
Tx=XM repeater channels

Reception of a strong signal originated in the WCS D, A2 or B2 blocks together with an XM SDARS repeater signal can result in third-order intermodulation products that fall within the Sirius S1 or S2 satellite channels and cause service disruption

*e.g. 2*2338.75 - 2346.0 = 2331.5 MHz (within the Sirius S2 satellite channel)*

Illustration of Frequency Range of Third-Order IM Products

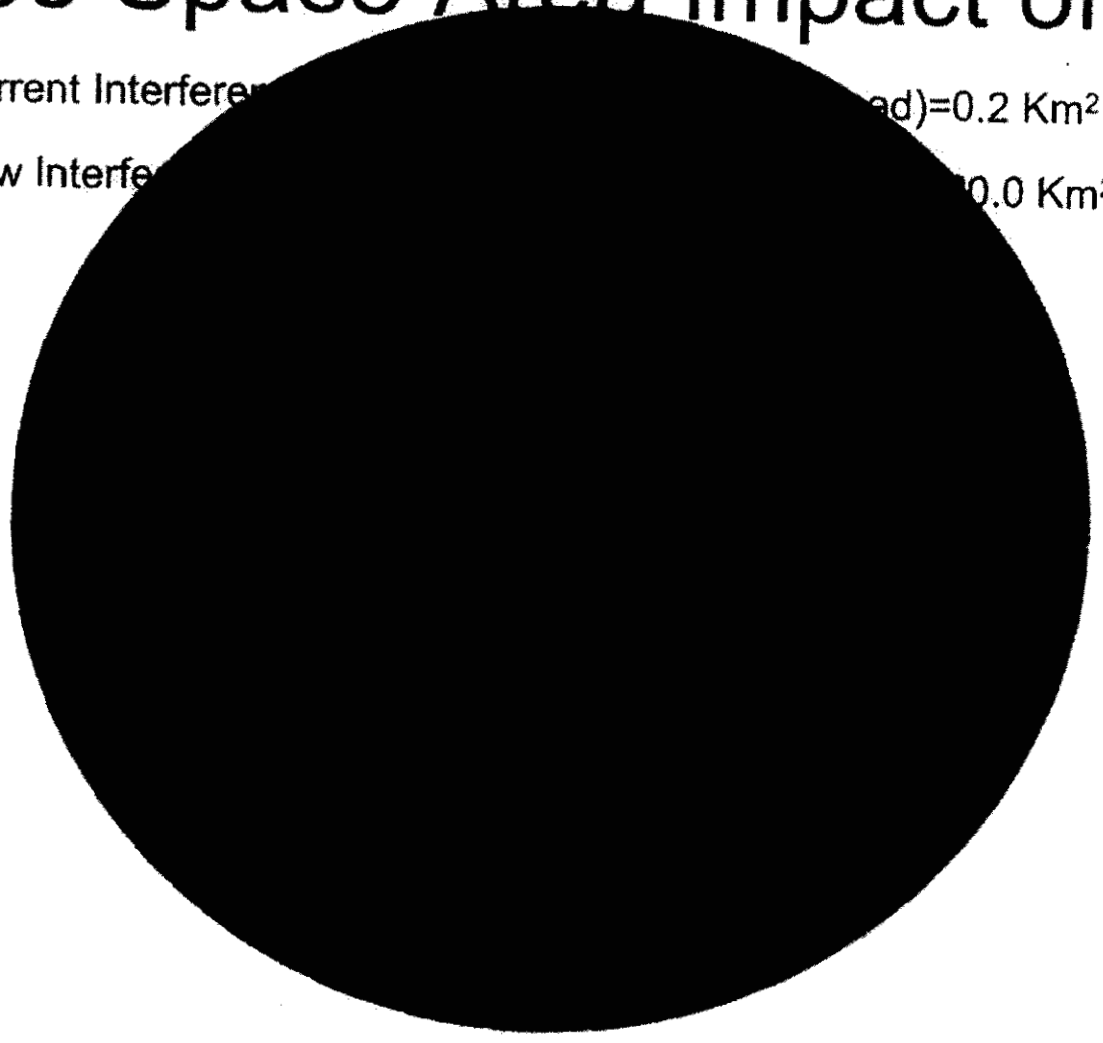
IM3 Products from D and Upper A & B WCS Bands interacting with XM Terrestrial in Sirius Satellite Bands



Free Space Area Impact of IM3

Current Interfere ad)=0.2 Km²

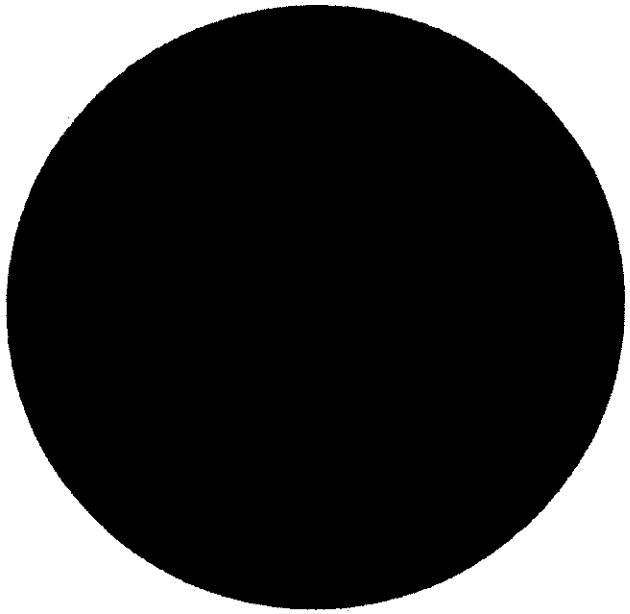
New Interfe 0.0 Km²



Example Area Impact of IM3 in Mixed Clutter*

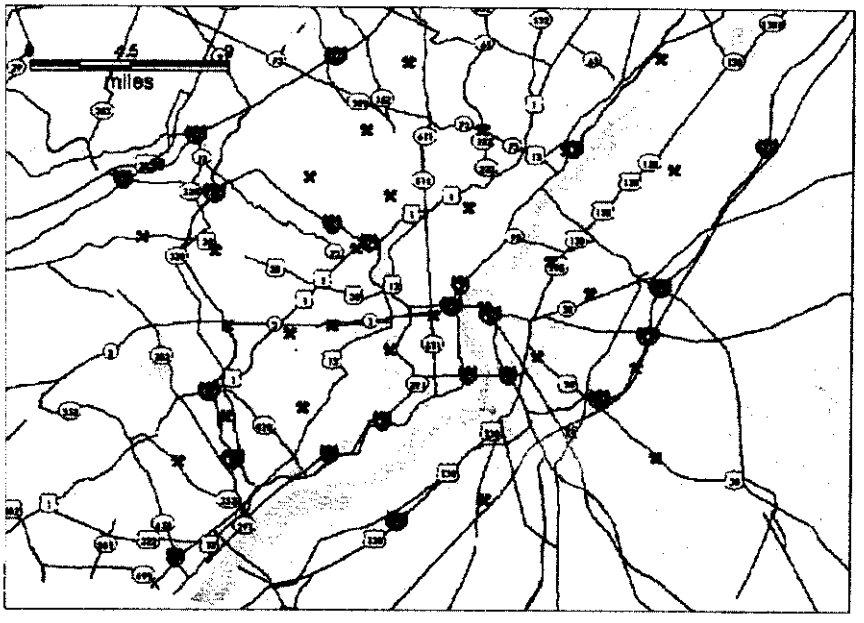
Current Interference Area (due to front end overload)=0.07 Km^2

New Interference Area (due to front end intermodulation)=~ 7.0 Km^2



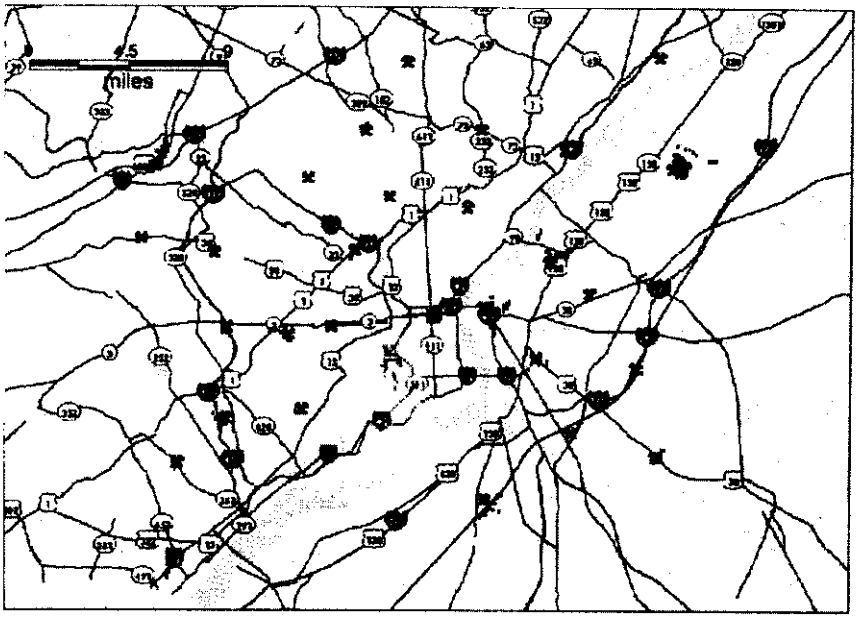
* terrain effects.

Philadelphia Market
XM Interference areas, current



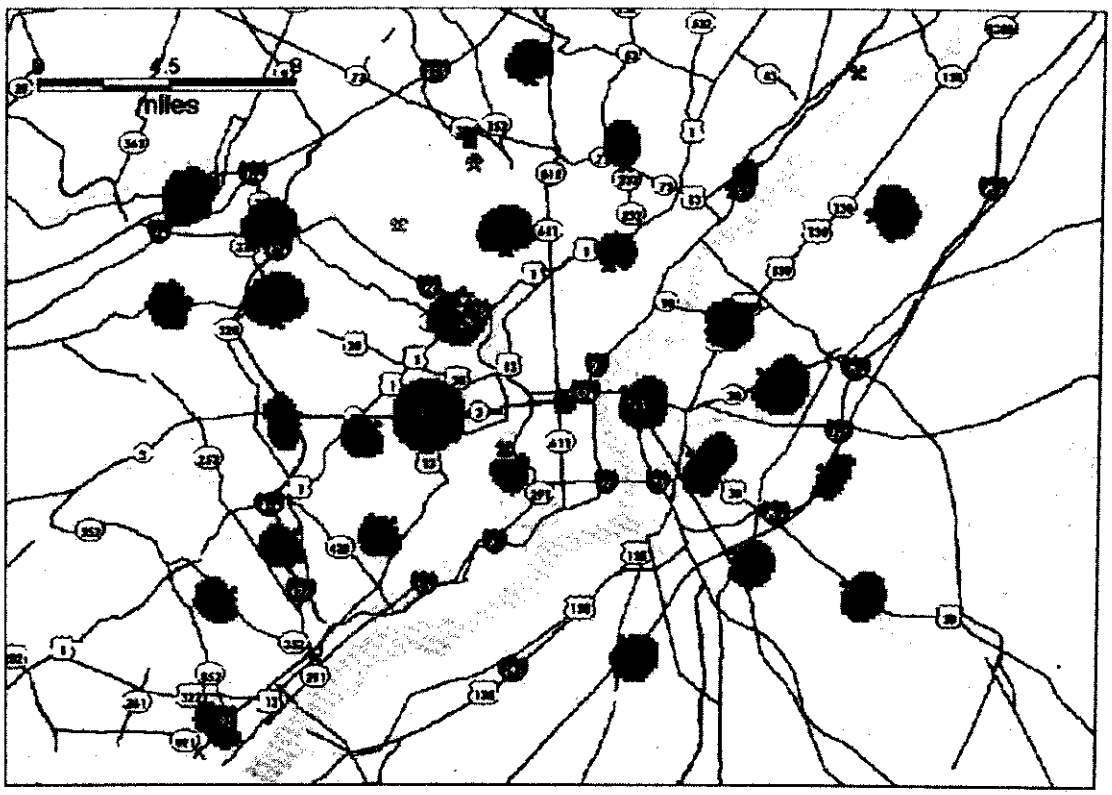
Model=CRC Predict with 200 meter resolution clutter layer

Philadelphia Market
new XM Interference areas (purple), co-located WCS



Model=CRC Predict with 200 meter resolution clutter layer

Philadelphia Market
XM Interference areas, co-located WCS
Free space model



Philadelphia Market – Cumulative Area of Interference

XM (receiver overload)	.05 sq. Km
XM/WCS IM3 (assuming urban clutter)	12.95 sq. Km
XM/WCS IM3 (assuming freespace propagation)	173.5 sq. Km

Summary

- This exhibit has demonstrated how the co-location of XM SDARS transmitters and WCS transmitters could cause new intermodulation products and consequently disrupt Sirius service.
- Receiver measurements have been presented that show the level at which this disruptive interference will be caused to Sirius service by this new mechanism.
- Examples have been presented showing the increase in interfering areas that will occur using both free space estimates and a real world market example. In all cases the increase in area is significant.

ENGINEERING CERTIFICATE

I hereby certify that I am the technically qualified person responsible for the preparation of the engineering information contained in the technical portions of the foregoing Petition, that I am familiar with the Commission's rules, and that the technical information is complete and accurate to the best of my knowledge and belief.

Terry Smith
Sr. Vice President Engineering
Sirius Satellite Radio Inc.
August 3, 2005

Certificate Of Service

I, Barbara Lampich, do hereby certify that on this 3rd day of August, 2005, the foregoing "Petition to Deny of Sirius Satellite Radio Inc. and Request for Removal from Streamlined Processing" was served on the following persons via first class mail, postage prepaid:

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